



TEMPO: Tropospheric Emissions: Monitoring of Pollution

NASA and the Smithsonian Astrophysical Observatory in Cambridge, Mass., are collaborating to launch the first space-based instrument to monitor major air pollutants across the North American continent hourly during daytime. The instrument, called TEMPO (Tropospheric Emissions: Monitoring of Pollution), will provide data to revolutionize air quality forecasts and enable effective early public warning of pollution events.

Air pollutants, like ozone and atmospheric particles, called aerosols, are known to be major causes of aggravated childhood asthma and respiratory diseases, as well as cardiovascular disease. However, current air quality observations, specifically networks of ground-based sites, are ineffective in both monitoring exposure to air pollution as well as in tracking the sources of pollution events. With TEMPO, researcher will make for the first time continuous observations of air pollution from a geostationary platform, allowing researchers and regulators to monitor and track air pollutants across the entire U.S., Canada and Mexico.



The TEMPO instrument will collect high-resolution measurements of pollutants, measuring the key elements involved in tropospheric ozone chemistry and aerosol cycles. Researchers will be able to use this data to study how emissions and chemical transformations interact strongly with weather and sunlight to monitor continental-scale transport of pollution. Observations from TEMPO and other platforms will be integrated into air quality forecast models to improve representation of processes especially the transport of pollution on regional and intercontinental scales.

TEMPO at a Glance:

What is TEMPO? TEMPO is the first ever space-based instrument to monitor major air pollutants across the North American continent hourly during daytime.

Why do we need TEMPO? Air pollution is known to cause cardiovascular and respiratory diseases, and the current monitoring network is inadequate. TEMPO data can eventually be used in applications to provide air quality alerts for people with health issues, first responders, hospital personnel, school administrators, and transportation industry officials.

Who leads the mission? Funded by: NASA's Earth System Science Pathfinder Program; Principal Investigator: Kelly Chance from the Smithsonian Astrophysical Observatory in Cambridge, Mass.; Project Scientist: David Flittner, NASA's Langley Research Center in Hampton, Va.; Project Manager: Wendy Pennington, NASA's Langley Research Center

When will it launch? TEMPO will launch in the 2019 time-frame, perfect timing for the mission to be a component of a global geostationary constellation for pollution monitoring along with Europe and Asia.

TEMPO will capture some of the data identified as critical in the National Research Council's (NRC) most recent Decadal Survey. This survey is done, as its name suggests, once each decade to look out ten or more years into the future and prioritize the research areas, observations, and notional missions to make those observations. TEMPO provides an innovative, cost-effective

approach to achieve international science goals, as recommended by the NRC. Specifically, TEMPO will be NASA's first commercially hosted payload, which means the instrument will hitch a ride on a satellite that is owned and operated by a non-NASA company or organization, most likely a telecommunications satellite.

TEMPO will launch in the 2019 timeframe, perfect timing for the mission to be a component of a global geostationary constellation for pollution monitoring along with Europe and Asia. The mission costs approximately \$90M, with a substantial cost-savings (nearly \$200M) coming from the fact that the mission will be a hosted payload on a commercial spacecraft.

Principal Investigator Kelly Chance from the Smithsonian Astrophysical Observatory in Cambridge, Mass., leads TEMPO. The mission's Project Scientist is David Flittner, and the Project Manager is Wendy Pennington, both are based at NASA's Langley Research Center in Hampton, Va. Additionally, the team includes partnerships with Ball Aerospace and Technologies Corp., in Boulder, Colo.; NASA Langley; NASA's Goddard Space Flight Center in Greenbelt, Md.; the U.S. Environmental Protection Agency in Research Triangle Park, N.C.; and several U.S. universities and research organizations.

TEMPO is the first Earth Venture Instrument (EV-I) mission to be awarded by NASA's Earth System Science Pathfinder program. These missions are small, targeted science investigations that complement NASA's larger research missions.